Before the
Federal Communications Commission
Washington, DC 20554

In the Matter of	)	
	)	
AIRCELL, INC.	)	WT Docket No. 02-86
	)	DA 03-721
Petition for Extension of Waiver	)	

To: The Commission

REBUTTAL TO REPLY COMMENTS OF AIRCELL, INC.
AND
MOTION FOR LEAVE TO FILE REBUTTAL

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EXHIBIT I: V-Comm, Inc., Engineering Response to AirCell's Reply Comments

SUMMARY

AirCell's Reply is filled with factual errors or, worse, prevarications. For example, AirCell claims that Commenters moved AirCell's receive antennas below treetop level for the flight test to bias the test results. The antennas were never moved down, however; they remain at the locations AirCell agreed upon. Moreover, AirCell cannot even get its own antennas straight — the antennas it complains about are transmit antennas, not receive antennas, and the one partially below treetop level was not involved in the test at all!

AirCell also tries to impugn the test results by raising misleading questions. It questions the validity of the flight test results, for example, because it had only inspected one of the three airplanes' radio installations. It ignores, however, the fact that all three installations were performed by its own factory-trained installers. It also fails to point out that the only reason two of the planes were not inspected was that AirCell reneged on its agreement to inspect them.

Similarly, AirCell also questions the validity of the test results because it covered an area outside the territory served by the ground station used, and that another ground station would have handled some of the traffic. AirCell never mentions that the other ground station was added to its network only *after* the test. And AirCell raises questions about how the cell used for the flight tests was configured, without even acknowledging that it had optimized the site itself before the test! It claims the site should have had "smart" antennas, but does not tell the Commission that it had designed the site to work without them — nor does it admit that it suggested smart antennas for the site only after it was selected for the flight test.

AirCell engages in engineering chicanery, as well. It turns much of its attention to distorting the concept of the "noise floor" beyond all recognition. First, it claims that almost all of the readings taken during a 24-hour noise floor test should be discarded, citing an out-of-context snippet from an obsolete instruction manual from AT&T, which has not been in the cellular infrastructure business for seven years. (Its successor, Lucent, confirms the misuse of the language from the manual.) Then, it says that the remaining noise level readings, which represent isolated short-term peaks, should be treated as though they represent the actual noise level throughout the day. It discards all of the significant results and then "recasts" the remaining hairline-thick bars on the histograms by magnifying them. Comparing the chart of noise levels actually measured with the chart of AirCell's doctored results shows that AirCell almost literally makes mountains out of molehills.

AirCell inflates the noise floor dramatically by this illegitimate "recasting" process. It then claims that the minimum acceptable call must be 17 dB above this level at any time of day. For one cell, AirCell elevates the noise floor by 20 dB to –105 dBm. Even though calls are routinely received at this level (and lower) with high quality throughout the day, AirCell considers this to be the noise floor, implying that all calls at the site would have to be 17 dB higher!

AirCell makes invalid objections to every aspect of the noise floor tests conducted by V-Comm. In fact, the tests were conducted at sites that are highly representative of typical cell sites with normal characteristics in a variety of environments, using properly calibrated test equipment and normal cellsite settings.

AirCell's similar strident objections to the flight tests are equally invalid. It claims, for example, that the flight patterns used were "impossible" to fly and not permitted by the FAA. In

fact, the patterns were designed to link together typical straight-line flights that are representative of typical aircraft flight patterns, and all of the flight patterns were approved by FAA air traffic controllers. It objects to the fact that the receive sites used for the test did not have downtilted antennas, but they were typical, unmodified sites; most suburban and rural sites in the area do not employ downtilted antennas.

AirCell also makes invalid objections to the interference drive tests. As with the flight test, it claims without basis that the site was somehow specially selected or configured. In fact, the site was a typical suburban site that was not manipulated in any way for the test; it was configured and operating normally, with digital and analog settings at normal levels. AirCell also objects to the very use of actual drive tests for assessing interference potential, claiming that there are too many variable, uncontrolled factors. This is a curious objection coming from AirCell, which objects whenever its opponents conduct tests that *do* control factors such as power levels in order to obtain consistent, controlled results, claiming that such controlled tests do not assess "typical operation." In fact, the drive tests produced reliable, repeatable results by using the same roads, consistent speeds, and consistent measured noise and traffic levels.

AirCell also objects to the V-Comm Case Study, which shows the devastating effect that AirCell operations will have on terrestrial service. AirCell's only argument addressed specifically to the Case Study, however, is that AirCell has a better model and a database covering nearly a million miles of flights. AirCell, however, has kept these secret. It provides no details of its model or its data collection, and again implores the Commission, "Trust us." The Commission can only base its decision on what is in the record, not on what parties choose *not* to file. Despite supposedly having this mountain of test data, AirCell has relied for its waiver extension solely on the very limited 1997 test data.

Instead of providing the million-mile database, AirCell provides only two very limited, selected snippets. These new sets of data, however, do not support AirCell's position. Moreover, they lack critical information, making it virtually impossible to evaluate the test results. Moreover, neither of the two newly presented tests presents evidence regarding situations where interference is most likely to occur. Either AirCell has no data covering such situations, or it is selectively excluding such data from the record.

AirCell also produces three new noise floor measurements that undermine, rather than support, its claims of a much higher noise floor. Two of its measurements support V-Comm's conclusions in the noise floor study. The third new noise floor measurement, a CDMA noise plot, is misleading, because it does not depict the full range of measured noise plus interference levels. Moreover, the chart contradicts AirCell's own use of a –98 dBm CDMA noise level.

Finally, AirCell's 1998 report by Dr. John Doner (revealed for the first time here) makes a point that Commenters and V-Comm have repeatedly tried to bring to the Commission's attention — namely, that interference to terrestrial systems from airborne transmitters is essentially undetectable, and terrestrial system operators are powerless to take action when it occurs. The interference from AirCell operations will be similar to that described by Dr. Doner. This demonstrates the infeasibility of the complaint-based enforcement system the Commission has decreed for confining AirCell to secondary status. Because terrestrial providers will not be able to identify airborne-originated interference, as Dr. Doner states, they will not be able to take steps to address it when it occurs.

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AT&T Wireless Services, Inc. ("AWS"), Cingular Wireless LLC ("Cingular"), and Cellco Partnership d/b/a Verizon Wireless ("Verizon") (collectively, "Commenters") hereby submit their rebuttal to the Reply Comments of AirCell, Inc. ("Reply"). To the extent necessary, Commenters move for leave to file this rebuttal.[1]

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[1] As discussed in detail herein, AirCell's Reply contains numerous technical and factual errors, as well as mischaracterizations of the testing conducted by Commenters and their consultant. AirCell has reiterated these errors and mischaracterizations in subsequent *ex parte* filings. *See, e.g.*, AirCell *ex parte* presentation, "AirCell Update" (Sept. 3, 2003). Commenters engaged their consultant, V-Comm, Inc., to prepare a detailed analysis of AirCell's errors and mischaracterizations and a technical and factual response to correct the record. V-Comm's "Engineering Response to AirCell's Reply Comments" ("V-Comm Response") is included as Exhibit I. Clearly, the public interest will be served by having a full, complete, and correct record for evaluation of AirCell's Petition for Extension. Accordingly, good cause exists for formal consideration of this rebuttal.

Commenters note, in this connection, that the initial AirCell proceeding was made subject to "permit but disclose" *ex parte* rules in order to encourage parties to submit relevant data in the interest of a more complete record. Public Notice, DA 97-2309 at 1 (Oct. 31, 1997). There has been no comparable ruling exempting the Petition for Extension from the "restricted" *ex parte* rules. Nevertheless, the 1997 public notice appears to remain operative, given that the Commission has entertained several AirCell *ex parte* presentations that would otherwise be prohibited. Failure to consider this rebuttal would be inconsistent with the Commission's desire to have a complete record, as stated in the 1997 public notice, would disserve the public interest, and could lead to a factually inaccurate and incomplete decision.

This rebuttal is being filed to set the technical and factual record straight, not to reargue the legal and policy issues Commenters have already addressed in their Comments in Opposition. Accordingly, Commenters will not address Section I of AirCell's Reply other than to state their disagreement. Section II of AirCell's Reply, however, contains criticisms of Commenters' technical tests and conclusions that are highly inaccurate and cannot stand uncorrected. The limited purpose of this rebuttal is to respond to the inaccuracies and prevarications in that section of the Reply and its supporting exhibits.

I. AIRCELL'S CRITICISMS OF THE V-COMM AMPS NOISE FLOOR STUDY ARE MERITLESS

A considerable portion of AirCell's reply is devoted to attempts to invalidate the AMPS noise floor study conducted by V-Comm. V-Comm provided concrete evidence that the noise floor in an urban/suburban cellular system is very low, permitting terrestrial cellular traffic to be carried reliably and with high quality in the real world at received signal strength levels considerably lower than textbooks suggest. Traffic at these low levels would receive harmful interference from AirCell airborne transmissions. For example, the -127 dBm median noise floor measured by V-Comm means that "cellular calls can operate at -110 dBm, with 'toll quality' (17 dB C/I). Any outside-system interference that is received above -127 dBm has the potential to cause interference to AMPS terrestrial cellular calls operating at the -110 dB level."[2]

Recognizing that its operations are incompatible with the low-level terrestrial traffic that is possible in a low-noise environment, AirCell tries to attack V-Comm's showing that such a low-noise environment exists. Its criticisms are unfounded, however.

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[2] V-Comm Report, § 4.2, *quoted in* Comments in Opposition at 43-44.

A. Discarding of Virtually All of the Measured Noise Floor Data

First, AirCell claims that V-Comm should have discarded nearly all of the measured noise floor data. AirCell, however, relies on language excerpted from what appears to be an obsolete instruction manual for this position. It cites a manual from AT&T, the original manufacturer of the cell-site equipment used for collecting the data, for the proposition that V-Comm erred by not discarding the lowest three non-zero bins of data.[3] AT&T, however, has not been in the equipment business since 1996, when it spun manufacturing off to a new company, Lucent. Current documentation provided for the Lucent cell site equipment does not contain the language quoted by AirCell.

Moreover, V-Comm points out that Lucent does not agree that the lowest bins of data need to be discarded:

> AirCell's claim is not correct. Lucent was an active party to the testing, providing insight after reviewing the test plans, tests, and processing of data, as Lucent indicated in its comments submitted to the Commission (filed on 4/10/03). As such, V-COMM received input directly from Lucent's subject matter experts on the testing and post-processing methods. In addition, Lucent Technologies' subject matter experts reviewed AirCell's Reply Comments regarding the referenced quote from the old AT&T manual, and provided the following feedback. Lucent's PLM subject matter experts state they neither recommend, nor agree with the removal of the lowest bins of non-zero data.[4]

Lucent confirms this. In a recent filing, Lucent states:

> AirCell claims that V-COMM did not follow the rules related to the PLM tool and thereby suggests that Lucent's audit of this

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[3] *See* Reply at 38 & n.117; AirCell Engineering Review of V-Comm Reports ("AirCell Review"), Exhibit B to Reply, at 2.2-14 n.13. The Reply cites "Lucent Autoplex Manual at 8" but provides no further identification of the document or its date of publication, giving the incorrect implication that it is referring to a current Lucent manual. Slightly more detail, but not the publication date, is provided in the AirCell Review, which cites "AT&T (now Lucent) manual, 'Special Studies Measurements,' Autoplex Cellular Telecommunications Systems, p.8."

[4] V-Comm Response at 8 (emphasis in original).

> process was less than thorough. AirCell's claim and suggestion are wrong. V-COMM did, in fact, consult with Lucent regarding the method of processing PLM data. AirCell argues that some readings at the lower end of the measurement range should be discarded, evidently basing this objection upon a statement within an old AT&T Corp. manual that points out the lowest values obtained represent noise rather than interference.[4/] As V-COMM's purpose was to obtain a baseline of total impairment (i.e., thermal noise plus other sources of cochannel interference), the retention of these values was appropriate. The statement from the AT&T manual is taken out of context, and does not apply to V-COMM's intended use of the data.
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> ---
>
> [4/] . . . The manual to which AirCell refers was produced by the AT&T business unit that developed and sold wireless infrastructure prior to the 1996 split of AT&T into three separate companies. In 1996, this AT&T unit became part of Lucent Technologies, Inc. [5]

V-Comm further observes:

> Cell sites having low operating noise levels will have their interference plus noise levels at or near the equipment's noise floor level. Co-channel and adjacent channel interference is being measured on the channel during the entire period. Due to the engineering and optimization of the cellular network, the interference plus noise floor conditions were very quiet. Consequently, the cellular AMPS spectrum can be fully utilized and the networks can offer improved coverage, capacity and quality of its service to its subscribers.[6]

Almost all of the measured noise plus interference data fell in the three lowest non-zero bins that AirCell claims should have been eliminated.[7] In other words, AirCell would have the

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[5] Ex Parte Further Comments of Lucent Technologies, Inc., Docket 02-86, at 1 (filed Oct. 9, 2003).

[6] V-Comm Response at 9.

[7] The histograms for many of the cells did not have more than three noticeably non-zero bins, *see* AMPS Noise Floor Study, V-Comm Report, § 9.17, at 30, 32, 37, 39, 43-45, in which case AirCell's logic would dictate discarding all of the measured data for the entire 24-hour period. In the others, the lowest three non-zero bins contained the vast majority of the measured data. (For all but one of the cells, the lowest three bins contained 87% or more of the measurements; in one dense urban cell, the lowest three bins accounted for 65% of the measurements.) *See id.* at 28, 29, 31, 33-36, 38, 40-42.

Commission believe that the way to measure the noise floor is to disregard almost all noise measurements. Only by denying reality can AirCell sustain its use of a much higher injected noise level in its tests.[8]

V-Comm notes that AirCell did not discard the lowest three non-zero bins of data from its own noise floor tests in 1997.[9] In fact, AirCell's 1997 noise floor tests — in a quiet rural environment — have some 95% of the measured data in the lowest bin (-131 dBm), but AirCell did not selectively recast or remove the lowest three bins of data.[10] Moreover, the noise floor level that AirCell's consultant, WSE, injected in its tests was about 13 dB higher than the level suggested by AirCell's own 1997 tests, a fact AirCell does not explain.[11] The noise floor measured in the V-Comm tests is similar to the level measured by AirCell's consultant, TECC, in 1997.[12]

For these and other reasons more fully explained in the V-Comm Response,[13] AirCell's criticism of V-Comm for its noise floor measurement techniques is misleading and unwarranted.

B. AirCell's "Recasting" of the Measured Noise Floor Data

After discarding virtually all of the measured noise and interference data, AirCell then "re-casts" the remaining data for each cell, which it claims represents "the relevant co-channel interference."[14] It does this by amplifying the probability of received signal strength in the remaining bins, which it estimates by "visually, manually examining the paper copy V-Comm

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8 *See* V-Comm Response at 9-10.
9 *See id.* at 10.
10 *See id.* at 10-11.
11 *See id.* at 11.
12 *See id.*
13 *See id.* at 11-13.
14 Reply at 39.

plots and entering the percent values into an Excel spreadsheet."[15] Given that the vast majority of the data points were in the three bins AirCell discarded, however, this means that AirCell is turning the insignificant number of remaining data points into a probability plot, by comparing the thickness of hairlines.[16]

AirCell's "recasting" truly makes mountains out of molehills. For example, V-Comm's histogram for Camden, Site #10, showed over 99% of the noise level measurements in the lowest two bins, with only barely perceptible, hairline-thick bars in two higher bins, representing less than 1% of all the measurements. AirCell "recasts" these two insignificant bins of noise readings as though they represented the total probability of the measured noise level over 24 hours. V-Comm's histogram and AirCell's recasting of it are reproduced below in Figure 1 on the following page.

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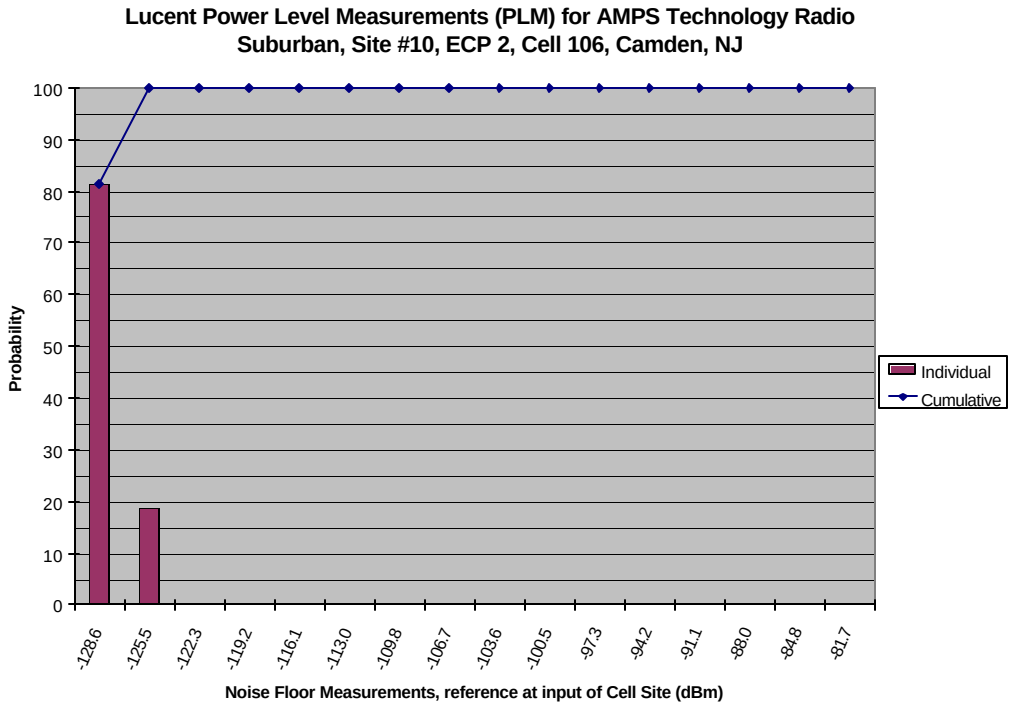
15 AirCell Review at 2.2-15.

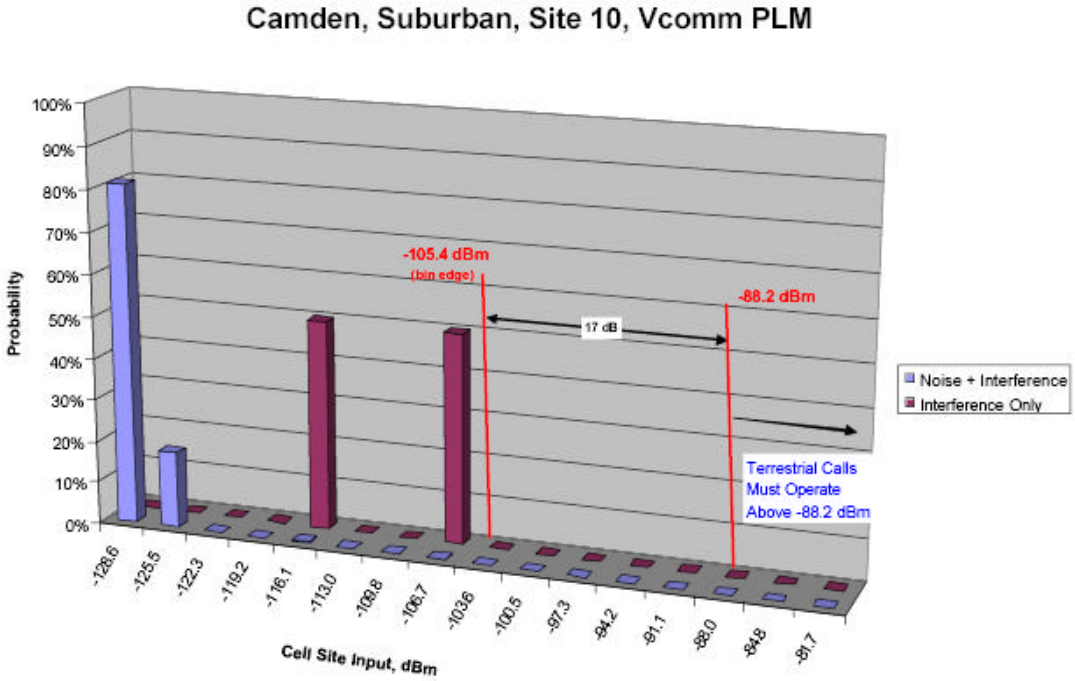
16 It is worthy of note that AirCell does not follow its own rule of discarding the lowest three non-zero bins when it does not need to do so to reach its predetermined result. AirCell's analysis of the noise floor data for the Center City site included the data from the lowest three non-zero bins, because the three lowest bins contained zero data points, so the three lowest *non*-zero bins were higher than the lowest three bins at the other sites. *See* AirCell Review at 2.2-18.

Figure 1. **Noise Floor Histograms for Camden Cellsite, V-Comm vs. AirCell.**

a. V-Comm's Histogram (Noise Floor Study at 37)



b. AirCell's "Recasting" of the V-Comm Histogram (AirCell Review at 2.2-25)



V-Comm explains why AirCell's approach is faulty:

> The data represent the fluctuation in the noise floor across the hours of the day, and within each hour, from the highest to the lowest noise floor values. To only consider the highest, peak noise floor value that occurs for extremely brief moments in time (i.e. for only seconds within a 24-hr period) is not meaningful or significant. For example, a peak noise floor level reading occurring for 30 seconds in a 24-hour period only represented the noise floor of the wireless network 0.03% of the time. And, 99.97% of the time, the actual noise floor levels are much lower than this peak. AirCell's reliance on the peak, highest noise floor value for its analyses is flawed as it only represents a statistically insignificant period of time when compared to the actual operating noise floor for the majority of the day. For these reasons, the median noise floor value should be utilized for analyzing interference from secondary services in cellular spectrum.[17]

By focusing only on the statistically insignificant short-term peak noise levels, AirCell portrays each cell as having a much higher noise floor than is actually the case. AirCell then asserts that the minimum received signal strength of an analog call — throughout the day — must be 17 dB above this artificially inflated noise floor, at the level of -88.2 dBm![18] V-Comm explains the absurdity of this approach:

> [W]ireless carriers expend significant engineering efforts optimizing their networks and the peak periods of the day are the most difficult periods. A carrier's radio engineers typically utilize channel assignment algorithms, underlay/overlay algorithms, and other technologies to optimize the performance of their networks, however these algorithms provide less improvements in the busiest minutes of the day (i.e. when all channels are utilized at all the surrounding cell sites at the same time). This is how practical wireless systems operate, providing quality service for the majority of the day. It is not practical to build a wireless network that provides 17 dB carrier to interference (C/I) margin 100% of the time to 100% of the coverage areas. . . . Typical design criteria is 90% for coverage availability . . . . However, ***AirCell seems to overlook these tolerances in its assessment that operating signal level of all terrestrial cell sites must be 17 dB above the peak,***

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17 V-Comm Response at 13.

18 *See* Reply at 39-40.

> ***highest noise floor level, all the time. This is a highly impractical assessment. It is impossible for a carrier to maintain the 17 dB margin of signal to interference level 100% of the time for 100% of the calls on 100% of its cell sites. This would require building cell sites on every corner of every street, and on every floor of every building, to provide service to every single call on its network at the 17 dB C/I margin 100% of the time.***[19]

AirCell highlights the absurdity of its own "recasting" of the noise floor when it claims that 22% of all calls at the Camden cellsite are "impaired" because their received signal strength is less than 17 dB above the recast noise floor. V-Comm's noise floor histogram for this site showed that over 99% of all noise plus interference measurements fell in the two lowest bins, and that the noise floor for the site was therefore about -125.5 dBm. AirCell threw out both of these bins and used the only remaining data — hairline-thick bars in two higher bins — to characterize the noise floor as being -105.4 dBm.[20] As the diagrams in Figure 1 above show, the actual noise plus interference level is about 20 dB lower than AirCell would portray it throughout the day. Calls that are less than 17 dB above the AirCell-derived noise floor are extremely unlikely to be impaired, because they are well in excess of 17 dB above the actual noise floor that prevails at all times except the briefest peaks.

In fact, a call could be received virtually any time with industry-standard quality, at 17 dB above the actual noise floor, but AirCell would deny this is possible, holding that such a call is 3 dB below its artificially inflated noise floor. As V-Comm puts it, "The FCC should also consider that carriers have optimized their networks, and for most of the day the noise floor is much quieter than the peak, busiest time of the day. Terrestrial cellular service is the primary service in the band, and is entitled to fully utilize the spectrum in the quieter times of the day. . . . There are significant public benefits in preserving the existing wireless services, and the

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19 V-Comm Response at 13-14 (emphasis added).

20 Compare Noise Floor Study at 37 with AirCell Review at 2.2-25.

FCC must protect these services from harmful interference. In addition, the same protection should be provided for the advanced wireless services being offered by carriers, including high-speed Internet access and other advanced voice and data services."[21]

AirCell's contention that the Commenters have not used "typical" network parameters for their noise floor study[22] cannot be sustained. Commenters used actual received noise floor measurements throughout a 24-hour period, which showed very low noise levels at virtually all times and thus is appropriate for determining typical system operation. AirCell's elimination of virtually all the noise floor data and use of only unrepresentative short-term peak noise level data has nothing to do with "typical" system operation.

C. The Noise Floor Data vs. a -100 dBm Minimum Call Level

AirCell claims that the noise floor data show that the "minimum reverse channel signal level would have to be -100 dBm," based on "current, real-world measurements," and is consistent with the FCC's use of that figure for C_{min} in its *AirCell Remand Order*.[23] AirCell is able to reach this conclusion, however, only by eliminating almost all of the measured data and "recasting" the noise floor to correspond to atypical short-term peak noise measurements. V-Comm points out that AirCell performs "invalid manipulations of valid measured data" in order to "pick and choose" the values that will support continuation its airborne service waiver.[24] In fact, the data show that the minimum signal level required is "much less than –100 dBm, and can be as low as –110 dBm while maintaining the 17 dB C/I margin at AMPS cell sites having an

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21 V-Comm Response at 15. V-Comm also shows that AirCell's claim that operating signal levels should be shifted upward by some 22 dB is "absurd," given that even an analog mobile phone at its lowest level cannot have its power increased by 22 dB, and a phone operating at maximum power cannot have its power increased at all. *Id.* at 14.

22 Reply at 41.

23 Reply at 43. Surprisingly, AirCell does not claim the minimum signal must be -88 dBm, based on its inflation of the noise floor for the Camden site (as depicted in Figure 1a above).

24 V-Comm Response at 14-15.

operating noise floor level close to their system noise floor, which is approximately –127 dBm."[25]

D. Objections to V-Comm's Noise Floor Measurements over 24 Hours

AirCell claims that by measuring noise levels over a 24-hour period, V-Comm has overemphasized quiet nighttime measurements and deemphasized higher daytime noise levels.[26] V-Comm points out, in response, that throughout the 24-hour period, "the variation in samples recorded during the busier times of the day (as compared to non-busy periods) is not statistically significant, and thus does not impact the overall results."[27] Moreover, V-Comm notes, AirCell's own 1997 noise floor study used the same technique of sampling the received noise and interference levels on a channel (when not active) over a 24-hour period.[28]

E. Receiver Calibration

AirCell objects to several aspects of V-Comm's receiver calibration protocol. First, AirCell maintains that V-Comm erred by leaving the antennas connected to the cellsite receivers when calibrating the receivers.[29] V-Comm explains that it used test methods that "allowed the calibration tests to be completed with antennas connected without impacting the tests."[30]

AirCell also claims that during calibration, the signal generator should have been connected to the cellsite's coupler input port.[31] V-Comm explains: "V-COMM utilized the cell site's coupler –50 dB port to perform the calibration measurements. This port has been measured to 50 dB below the input signal level at the coupler's input port . . . . This tolerance

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25 *Id.* at 15.
26 Reply at 38.
27 V-Comm Response at 16 (footnote omitted).
28 *Id.* at 18
29 Reply at 45.
30 V-Comm Response at 18.
31 Reply at 33, 45.

typically varies by less than 0.5 dB, and is typically measured to within a few tenths of the expected value of –50 dB, which matches the coupler port's specification."[32]

AirCell claims that V-Comm should have performed calibration tests on both receive diversity paths.[33] V-Comm notes in response that this was unnecessary, because it has found in the past that the two paths exhibit similar results (within 1 dB), and that the large number of sites used would have resulted in observation of any abnormal conditions. V-Comm also indicates that Lucent's subject matter experts concur that the performance of the two diversity paths can be expected to be similar.[34]

F. Criticism of Using PLM for Noise Floor Measurements

AirCell claims that V-Comm should not have relied on PLM measurements via the cellsite receive radios, and should instead have used more accurate test equipment to measure the noise floor.[35] V-Comm responds:

> [The PLM] tools are utilized by the vendor and carrier's engineers to perform signal and interference measurements on channels, as observed and measured by the cell site radios. Lucent states that these tools are accurate and are designed for such measurements. Further, the reason V-COMM performed calibration measurements on these receivers was to ensure the receivers were not performing abnormally and were reporting readings accurately and consistently. This allowed the cell site receivers to be utilized for such measurements. Also, the benefit of using the cell site receiver for these measurements is that it has the perfectly matched receiver specifications (resolution bandwidth, system noise figure, etc.) to the cell site receiver that is under test.
>
> The wireless carrier's radio engineers typically utilize these PLM mode 2 measurements to measure the system's operating noise floor levels, and they are consistent with acceptable engineering

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32 V-Comm Response at 19.

33 *See* Reply at 33, 34, 44, 45.

34 *See* V-Comm Response at 19-21.

35 *See* Reply at 33, 44.

practices. These levels are the operating noise levels experienced by the cell site receiver occurring throughout normal operation.[36]

G. "Atypical" Sites Chosen for the Noise Floor Test

AirCell claims that at least one of the eighteen sites used for the noise floor test may have been selected for its atypically low noise level.[37] V-Comm responds that "This is simply not true. These cell sites were selected as typical cell sites with representative signal and noise floor levels for sites in the market environments described as dense urban, urban, suburban, and rural areas within the NJ & Philadelphia, PA markets. . . . There was no effort to select the cleanest cell sites, sectors or channels. These were all selected to be representative of typical cell sites having normal operating noise floor levels within the market."[38]

II. AIRCELL'S CRITICISMS OF THE FLIGHT TESTS ARE INVALID

AirCell criticizes several aspects of the V-Comm flight tests, claiming that "the number and severity of errors in V-Comm's Noise Floor Study . . . is rivaled only by the scope of errors and misrepresentations apparent from a review of its flight tests and measurements of AirCell signals on the ground."[39] As shown herein, AirCell's criticisms are not supportable.

A. Criticism of Straight-Line Flight Paths and Bow-Tie Patterns

V-Comm employed straight-line flight paths, arranged in a "bow tie" pattern, in part of its flight testing. AirCell claims that these were "abnormal" flight patterns that are "impossible" to fly, and intimates that the FAA would never have permitted them to be flown.[40]

V-Comm responds as follows:

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36 V-Comm Response at 21.
37 Reply at 42
38 V-Comm Response at 22.
39 Reply at 45-46.
40 *Id.* at 48-49.

> First, the "ends of the bow-tie" were needed for logistical reasons, i.e. the aircraft needed to be turned around upon reaching the end of the AirCell site service area. Second, the flight segments with northern and southern headings were utilized to measure the AirCell signal strengths at different orientations to the terrestrial cell sites, i.e. aircraft heading toward, away from, and adjacent to the victim terrestrial cell sites where measurements were performed. The flight pattern consisted of a series of VOR stations to enable the flight segments to be representative of the typical "roadways in the sky" that general and commercial aviation aircraft typically utilize. These VOR stations were also used as navigation points to maintain on course. VORs are commonly used as waypoints in both VFR and IFR flights. Therefore, the straight-line flight pattern utilized in the V-COMM flight tests is representative of typical aircraft flight patterns within the tested area. In most cases, at the "ends of the bow-tie" pattern, AirCell service from the Marlboro site was not provided to the AirCell mobile. For example, within the flight segment from Sea Isle VOR to Modena VOR, the AirCell mobile was served by the AirCell Ellendale, DE site, and such measurements are not included in the V-COMM test results since we only performed measurements on the channel utilized by the Marlboro AirCell site. Therefore, these flight segments at the "ends of the bow-tie", furthest from the AirCell Marlboro site, do not contribute to any higher signals encountered as asserted by AirCell.
>
> Finally, all the flight patterns utilized in the V-COMM flight tests were coordinated and approved by the FAA's air traffic controllers for the area. The flight patterns followed the flight diagram provided by V-COMM in its report that was submitted to the FCC. . . .[41]

B. Treeline Obstruction of the Marlboro Antennas

AirCell claims that one set of antennas at the Marlboro site was improperly lowered by 15 feet, placing them below the treeline and destroying diversity reception at the site.[42] V-Comm's response is as follows:

> AirCell coordinated with Cingular's local operations staff to configure the AirCell base antennas for the Marlboro site. AirCell specified and agreed to the antenna mounting heights for these antennas. Further, AirCell's director of its engineering personnel

41 V-Comm Response at 24.

42 Reply at 51.

> came to the Marlboro site to configure the Marlboro site translation parameters settings, and fully optimize its Marlboro base site. For this optimization, AirCell performed visual inspections of the antenna system, installed its CTSU equipment, and performed numerous off-air tests and on-air flight tests on the Marlboro site, after it configured and optimized it. At the conclusion of its inspection and optimization of the Marlboro site, AirCell informed V-COMM that the Marlboro site was optimized in accordance to AirCell standards. From that time until the time AirCell submitted its Reply Comments to the FCC, AirCell neither stated that any of its base antennas were too low, nor indicated that any other condition existed that was not representative of other AirCell sites in its network.
>
> Further, in response to AirCell's comments, Cingular hired an independent contractor to locate and measure mounting heights of the AirCell antennas at Marlboro. This can be seen in the diagram and picture below (Figure 4-C [in V-Comm Response]). The AirCell receive antennas are mounted upright, as electrically up-tilted antennas purchased from Scala that are specifically tuned to the cell site receive band. The receive antennas are not mounted inverted as AirCell showed in their figure 2.3.b.13 . . . . Therefore the tree line does not have any impact on the V-COMM test results. If the antennas were mounted as labeled by AirCell in its Reply Comments, the Marlboro site would not have been operating properly. AirCell's engineering personnel should know which antennas are mounted upright vs. inverted; however they incorrectly pointed to the wrong antennas to manufacture an issue out of nothing. It can be seen that the tree line only obstructs AirCell's transmit antenna that is mounted on the lower boom, in the inverted position, which is connected to the cell site's linear amplifier #4 (LAC4). It should be noted that the channel utilized in the V-COMM phase 1 flight tests was from LAC3, which is connected to the transmit antenna on the upper boom that is inverted and not obstructed by the tree line. Hence, the V-COMM flight tests were not affected by the lowest inverted transmit antenna (that is the only antenna obstructed by the tree line), since that antenna was not utilized in its flight tests.[43]

In support, V-Comm shows on AirCell's photograph of the antennas that the antennas AirCell refers to are its *transmit* antennas and not its *receive* antennas,[44] and includes a statement

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43 V-Comm Response at 25-26.

44 *Id.* at 26 (Figure 4-B, reproducing and annotating AirCell's Figure 2.3.b.13).

from a Cingular official confirming the proper placement of the antennas that includes an antenna diagram.[45] In short, the AirCell receive antennas are mounted exactly where they have been for years, namely where AirCell agreed to have them mounted. An independent contractor has verified the antenna placement. They were not moved below the treeline.

C. Tests Beyond the Boundaries of the Marlboro Site

AirCell claims that V-Comm's flight tests extended beyond the area intended to be served by the Marlboro site and ignored the fact that the system was not fully built out in the area, citing the addition of a new site after the tests.[46] In fact, AirCell had never informed V-Comm that its network in the area was not yet fully built out. V-Comm states:

> AirCell has never mentioned that the Marlboro area was not fully built out. This is a new issue AirCell is attempting to introduce at the 11th hour in a proceeding that is studying its typical AirCell base station. The typical distance between other AirCell base sites around the U.S. is about 160 to 200 miles. AirCell has stated in the record that its base station's service radius is typically between 80 to 90 miles. However, after V-COMM conducted its flight tests utilizing the AirCell Marlboro site, AirCell decided to secure an additional cell site between the AirCell Marlboro, NJ site and AirCell Owego, NY site. This new AirCell site is located within cellular RSA PA#5, which is about half way between Marlboro & Owego.[47]

V-Comm notes that the spacing between AirCell's Marlboro and Owego sites was representative of AirCell site spacing at the time of the test, and that the addition of the new site, which cuts the cell service radius from about 80 to 40 miles only "after testing was completed for the Marlboro site," appears to be "a last resort attempt to discredit the V-Comm flight tests."[48]

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45 *Id.* at 72-75.

46 *See* Reply at 46-47.

47 V-Comm Response at 28.

48 *Id.*

V-Comm points out that even if the new site had been operational, it would have had only minimal effects on the test, and that AirCell's other new sites were too far away to have any significant effect on the flight test.[49] V-Comm also points out that "AirCell sites do not normally handoff," so that its test results would have been unaffected, because the call would have continued to be handled through the Marlboro site even if the new site had been in existence.[50]

D. Smart Antennas

At several points in its filing, AirCell faults V-Comm's tests because the Marlboro site had not been equipped with "smart antennas" as AirCell desired, which would have reduced interference.[51] V-Comm's response shows that this is simply an attempt by AirCell to avoid having its typical operation assessed. V-Comm states:

> AirCell's original agreement with the previous carrier that owned the Marlboro cell site (Comcast) only referenced the standard antenna configuration for this site. Only after AirCell heard that flight tests were to be conducted on the Marlboro site, did AirCell indicate it desired to install a smart antenna at this location to improve its compatibility with the terrestrial network. For this installation, AirCell needed to coordinate with Cingular (the new Licensee) to update its original agreement to include the operation of smart antennas on the tower. However, AirCell did not secure this agreement for this work to be implemented. Further, a tower study was needed to ensure the additional loading of the smart antennas did not exceed the tower manufacturer's design specifications for the structure. Hence, the AirCell Marlboro site is still in operation today, just as it was when AirCell configured and optimized it with its standard antenna configuration almost 4 years ago. The significant issue is that the AirCell Marlboro site, as tested by V-COMM in its Phase 1 flight tests, represents a normal and standard AirCell base site configuration that is similar and representative of the majority of the AirCell sites in the U.S. It should be noted that V-COMM made repeated requests of AirCell to allow flight tests at another AirCell site having a smart antenna system. AirCell indicated it had smart antennas installed at 3 other

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49 *Id.*

50 *Id.*

51 *See* Reply at 34, 46, 47 n.138, 54.

> AirCell sites in the U.S., but it would not cooperate to allow V-COMM to test at these sites. In any case, the smart antenna configuration needs to be considered by the FCC as a special case, as it's not standard base equipment for AirCell (3 deployments for 135 sites is very uncommon), and it is not listed as a technical requirement for operation pursuant to the AirCell waiver.[52]

E. Incorrect DPC Settings' Effect on the Tests

AirCell claims that an incorrect DPC setting at the Marlboro site during the timeframe of the flight test could have resulted in airborne signals being received at a higher level than they should, which would invalidate the test results.[53] V-Comm acknowledges that the "DPC Boost" setting was improperly enabled for one day of the testing, but this was discovered and the affected flight test data was not used in compiling the results.[54] As a result, "the flight tests submitted to the FCC are representative of AirCell base stations as optimized and configured by AirCell and in accordance with AirCell standards."[55]

F. Marlboro Site Not Equipped for Handoffs

AirCell claims that the Marlboro site was not set up to hand off calls to other AirCell sites, resulting in calls being handled for much longer periods of time and greater distances, calling into question the validity of the results.[56] V-Comm responds as follows:

> AirCell coordinated with Cingular's performance staff to set, configure and optimize all of the base site parameters prior to the Marlboro site going into commercial service, about 4 years ago. At that time, AirCell choose not to setup the handoffs for this site to any other of its neighboring sites. AirCell completed its optimization along with its necessary flight tests to ensure the

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52 V-Comm Response at 29 (footnote omitted).

53 Reply at 50.

54 V-Comm Response at 29. V-Comm asserts that AirCell was well aware that the error had been corrected and should have recognized that the invalid data was not used, because the DPC Boost would have resulted in DPC Level 2 transmissions, which were not included in any of the data reported for the DPC-enabled tests. *See id.*

55 *Id.* at 30

56 *See* Reply at 34, 47.

> Marlboro site was configured and operating in accordance with AirCell standards. AirCell conveyed to V-COMM the fact that the Marlboro site was optimized and was performing satisfactorily, at which time V-COMM subsequently performed the planned flight tests. During the time the V-COMM testing was performed, AirCell did not indicate that such handoffs were necessary for its standard operation nor required for this site. AirCell was fully aware of V-COMM's plans to perform such tests with the Marlboro AirCell site.[57]

V-Comm observes that it is very unlikely that AirCell sites are generally equipped to perform handoffs.[58] As a result, the fact that the Marlboro site was not handoff-enabled made it representative of typical AirCell sites. Moreover, V-Comm notes, even if handoffs had been enabled at the Marlboro site, there would have been little or no change to the test results.[59] V-Comm maintains that the distances from the aircraft to the Marlboro site during the test "are representative of normal operating conditions within the AirCell network," and the site's handoff configuration "would not have had a significant impact" on the flight test results.[60]

G. AirCell's Failure to Inspect Two Airborne Phone Installations

AirCell attempts to impugn the integrity of the V-Comm flight tests by stating that two of the three airborne phone installations had not been inspected by AirCell, and suggests that there

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57 V-Comm Response at 30.

58 *See id.*

59 *See id.* at 31 ("The Marlboro AirCell site would have served the airborne AirCell mobile for most of the Straight-line flight path, since it was the closest AirCell site to the flight path. Also, the handoff hysteresis function biases the call to remain on the serving site until a handoff candidate site received the signal level between 2 to 4 times as strong as the serving site. Only in the southern portion of the flight plan does the AirCell Ellendale, DE site serve the mobile. In the southern area of the flight pattern, between the Sea Isle VOR and Modena VOR, the AirCell airborne call was not served by the Marlboro site and was actually served by the Ellendale AirCell site on a different voice channel than measurements were being made at the 3 terrestrial cell sites. Only one voice channel from the Marlboro site was used for measurements at the terrestrial cell sites. So, the results submitted to the FCC did not include measurements from channels served by the Ellendale AirCell site, and only included measurements from calls served by the Marlboro AirCell site.")

60 *Id.*.

is no way to know if these installations were correct at the time of the test.[61] AirCell does not provide any reason to doubt that the installations were correct, however. Moreover, as V-Comm points out, all three installations were performed "at factory authorized AirCell installation facilities that are strictly controlled by AirCell."[62] In addition, V-Comm specifically and repeatedly invited AirCell to verify that all three installations were proper, but after AirCell had agreed to inspect them, it inspected one plane and reneged on its agreement to inspect the other two installations.[63] V-Comm notes that one of the two planes that AirCell did not inspect flew similar routes to those flown by the inspected plane, and the AirCell radios exhibited similar performance.[64]

As a result, there is no reason to suspect a problem regarding the radios' installation. AirCell has no basis for calling into question the test's validity. It cannot taint the test results by failing to live up to its agreement to inspect installations made by its own trained installers.

H. Downtilted Antennas

AirCell claims that the flight test is faulty because the "victim" receive sites did not employ downtilted antennas, which would have diminished the received AirCell signal level.[65] V-Comm's response is that the sites in question are typical of rural and suburban sites — at the time of the flight test, about two-thirds of the sites in the Cingular network used for the test did not have downtilted antennas, and seven out of ten suburban and rural Verizon Wireless sites used in the noise floor test did not have downtilted antennas, as well.[66] It notes that the sites were "not modified in any way," and that downtilted antennas are rarely used at rural sites such

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61 Reply at 34.

62 V-Comm Response at 32.

63 *See id.* at 31-32.

64 *See id.* at 32.

65 *See* Reply at 34.

66 *See* V-Comm Response at 33.

as Swainton, and that the Oak Hill site is a relatively short (50 foot) tower, where downtilt would not typically be used.[67]

I. Results of the V-Comm Arc Pattern Flight Tests

V-Comm notes that AirCell's engineering exhibit "agrees with the signal strength results of the arc pattern flights used within V-COMM's AirCell compatibility flight tests . . . [, which] can be used to study the compatibility to the terrestrial networks with an AirCell mobile operating at its maximum power level, and they are utilized to characterize the path loss component in V-COMM's Case Study analysis."[68] In fact, the test results largely agree with the 1997 AirCell tests. As a result, there is no question but that "the signal strength results of V-COMM's arc flight tests are valid."[69]

These tests were performed with DPC disabled, in order to determine path loss and the corresponding maximum potential signal strength of an AirCell signal.[70] V-Comm points out that these test results also "represent the *actual* AirCell signal levels" in three situations: (1) when the AirCell phone is operating at maximum power on a voice channel, which occurs when the mobile is at the greatest distance from its serving ground station and is close to sites in neighboring markets; (2) when an AirCell phone is about to hand off a call to another site; and

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67 *Id.*

68 V-Comm Response at 33-34.

69 *Id.* at 34.

70 AirCell objects to the fact that V-Comm conducted tests with DPC disabled (set to a fixed level), "as this is not how the AirCell system operates." Reply at 53. Commenters and V-Comm have previously explained that the DPC-disabled tests were not done to test how the AirCell system operates, but to measure path loss and maximum received signal strength under a variety of conditions. *See* Comments in Opposition at 36 & n.103, citing V-Comm Report at §§ 2.2.2, 3.2. This is consistent with the experimental regimen of controlled testing that AirCell advocates in its engineering exhibit, with all variables but the one being tested kept constant. *See* AirCell Review at 2.4-21, discussed below in Section III.C. AirCell also questions whether the tests with DPC enabled were somehow unauthorized. Cingular is fully authorized to conduct technical tests of its licensed facilities (including mobile units under the control of those facilities) to assess their interference potential, just as any cellular licensee is so authorized.

(3) when the AirCell phone is transmitting on its control channel during call setup or autonomous registration.[71] V-Comm points out that the results of the arc flight tests were also used "to determine the maximum range of AirCell signal levels to inject into terrestrial sites for V-COMM's Phase 2 interference tests with AMPS, TDMA & CDMA technology."[72]

III. AIRCELL'S CRITICISMS OF THE SYSTEM COMPATIBILITY INTERFERENCE TESTS ARE MERITLESS

AirCell makes numerous criticisms of the "Phase 2" tests performed by V-Comm to determine the extent of airborne interference with terrestrial analog and digital service. V-Comm's analysis shows that these criticisms are meritless.

A. General Objections

AirCell's engineering exhibit makes a number of general objections to the Phase 2 tests. It reiterates its objections to the way V-Comm measured noise plus interference levels and its claims that the Marlboro site used as the serving site for the flight test was misconfigured.[73] These objections have already been addressed. V-Comm's noise floor tests for the drive test site were conducted in accordance with standard industry practices; moreover, V-Comm points out that AirCell does not indicate how the noise floor tests had any bearing on the results of the Phase 2 tests.[74] V-Comm also notes that AirCell does not show how the serving site configuration for the flight test — which was correct, as discussed above — is relevant to the Phase 2 tests, which did not use airborne units or a serving AirCell site; the Phase 2 tests involved injection of simulated AirCell signals into a base station receiver during a drive test.[75]

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71 *See* V-Comm Response at 34.

72 *Id.* at 35.

73 *See* AirCell Review at 2.4-1.

74 *See* V-Comm Response at 37.

75 *See id.* The only effect of the flight tests on the Phase 2 tests was to determine the maximum simulated AirCell signal level to be injected.

B. Objections to the Ewingville Test Site

AirCell's engineering report objects that the drive tests extrapolated from the noise floor and flight tests and also used a "non-representative cell site configuration" at the Ewingville test site.[76] V-Comm responds that the drive tests were not "extrapolated" from the other tests, which were independent tests, and points out that the test site was in fact a representative suburban site that was not manipulated in any way for the test:

> [T]hese interference tests were performed with a typical suburban terrestrial site that was configured and operating normally. The site was representative of a typical suburban site, and was operating with same standard and normal settings as other cellular sites operate with in the surrounding market area and other areas within the country. These tests were utilized to characterize the impact of the AirCell system interference levels to the terrestrial networks. AirCell's criticisms in this respect are unfounded and inaccurate.
>
> The Ewingville site was selected as a representative suburban site. In contrast to AirCell's allegations, V-COMM did not modify the Ewingville site settings in order to skew the results of the interference tests. AirCell's allegation is blatantly incorrect and inaccurate. AirCell's entire justification for its Section 2.4 of its Engineering Report centers on the allegation that the Ewingville site was deceitfully re-configured to skew the results. This is absolutely not true. This site was chosen because its operating levels were representative of other suburban sites and no re-configuration was performed by V-COMM to skew the results of these tests.[77]

As evidence of the representative nature of the Ewingville site, V-Comm observes that the measured noise floor level at the site is the same as the median operating noise floor level for suburban and rural sites, as measured in the Noise Floor Test, and points out that four of the five suburban sites in that test had *lower* noise levels than Ewingville.[78]

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76 AirCell Review at 2.4-1.

77 V-Comm Response at 38 (footnote omitted).

78 *See id.*

AirCell claims that received call signal levels and mean opinion score ("MOS") data also call into question the representative nature of the Ewingville Phase 2 test site. V-Comm fully refutes these arguments at pages 39-41 of the V-Comm Response, attached as Exhibit I. Accordingly, only a brief synopsis is presented here. First, V-Comm shows that the Ewingville site's operating parameters are typical of the Cingular and Verizon Wireless networks. For analog and TDMA, its DPC level is set "**exactly** equal to the average value of Lucent's nominal range, as given by AirCell," and for CDMA, it was also configured with standard parameters.[79] Second, V-Comm finds that AirCell's estimation of the target DPC level "as the 50% median level of the site's call signal data" is erroneous; when analog and TDMA phones are already transmitting at maximum power, they cannot increase power, and even though their received signal levels will fall below the site's target settings the phones will "continue to hold the call," which V-Comm says is a "typical occurrence" in a terrestrial system.[80] Third, AirCell's contention that some calls were carried as low as -124 dBm is incorrect, according to V-Comm; the low signal levels recorded by the PLM are likely to represent noise received for up to 20 seconds after calls are dropped.[81] Fourth, AirCell's use of MOS scores to claim the site was not operating properly[82] was flawed, according to V-Comm; the MOS scores for the site with no injected interference were in the "good" range for both analog and TDMA.[83]

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79 *Id.* at 39 (emphasis in original).

80 *Id.*

81 *See id.* at 40. V-Comm also refutes AirCell's hypothesis that the route used for the drive test did not include the outer reaches of the cell's coverage area. Contrary to AirCell's assumption that the cell had a serving radius of 2.25 to 2.5 miles, V-Comm points out that the cell's outermost serving area is 1.5 miles from the site, and it was included in the drive test route. The drive test did not duplicate the lowest calling levels, because those calls typically come from in-building locations. *See id.*

82 *See* AirCell Review at 2.4-7 - 8.

83 *See* V-Comm Response at 40-41. AirCell, inconsistently, also claims that MOS score is an unreliable measure of quality, *see* AirCell Review at 2.4-9, a claim that V-Comm says is at

C. Flawed Analytical Techniques

AirCell argues that V-Comm employed experimental techniques in Phase 2 that were flawed in various ways. Among these objections is AirCell's claim that V-Comm failed to adhere to the "fundamental premise" that tests must be conducted under controlled conditions, with all variables but the one being tested held constant.[84] This is a curious objection coming from AirCell, which has previously objected to its opponents' fixing DPC at a constant level in tests in order to measure received signal level accurately, without being affected by varying DPC levels — an objection that AirCell repeats in its Reply.[85]

In particular, AirCell objects to V-Comm's use of "repeated drive tests under essentially uncontrolled field conditions."[86] V-Comm responds as follows:

> In preparing for the phase 2 testing, careful consideration went into driving the exact same roads with consistent speeds, and the noise environment and traffic levels were observed to be similarly consistent during the testing periods, which was very good for repeatable results. We reviewed customer traffic data for the test site, which had similarly consistent loading levels for the testing period between 9 am and 3 pm. Therefore, the drive testing, traffic loading, and noise environment was consistent, and allowed for repeatable results. This is observed in the data.[87]

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odds with its widespread use in the wireless industry to measure the audio quality of both analog and digital service. *See* V-Comm Response at 41. Ironically, AirCell premised its technical arguments for its initial waiver on MOS quality levels. *See, e.g.*, Exhibit B to AirCell, Inc. Petition for Waiver (filed Oct. 9, 1997), James E. Stinehelfer, *et al.*, AirCell, Inc. Analysis of AirCell Flight Test Data and Its Effects on Terrestrial Cellular Operations, at 5.

84 AirCell Review at 2.4-21.

85 *See* Reply at 53 ("[T]here is no valid reason for V-Comm to have presented test results based on the DPC fixed at maximum power, as this is not how the AirCell system operates."). This is addressed at note 70 above.

86 AirCell Review at 2.4-21.

87 V-Comm Response at 41-42.

AirCell also objects to V-Comm's use of multiple metrics for evaluating the effects of interference, and claims that the various metrics occasionally contradict each other.[88] V-Comm responds as follows:

> As the interference increases above levels where harmful interference is already indicated in the results, single metrics may be affected in different ways. For example, the MOS or dropped call metrics may appear slightly out of trend for single test results, when actually more calls are being blocked during these drive tests resulting in reduced coverage areas that serve calls along the drive route. At the increased interference levels, the impact of the AirCell interference prevents establishing and maintaining calls for much of the serving area of the terrestrial cell site.
>
> Also, the measurement interval for some metrics may be slightly larger than other metrics, which results in slightly more variability in the results. V-COMM's interference compatibility drive tests included many metrics to measure the entire impact to performance of the cell site. These tests include the following ten performance metrics: Dropped and Blocked Calls, Mean Opinion Audio Quality Score (MOS), Digital Error Rates, Carrier to Interference Ratios, Loss in Capacity, Minutes of Use, Mobile Transmit Power & Energy per Bit Noise Levels, and Overflowed Call for CDMA.
>
> Therefore, AirCell's assertions are incorrect. The results of the V-COMM interference tests exhibited repeatable and consistent results, and the entire data set of metrics need to be reviewed in consideration of the level in which AirCell signals cause harmful interference to the terrestrial network.[89]

IV. AIRCELL'S OBJECTIONS TO THE CASE STUDY HAVE NO MERIT

AirCell has consistently avoided any meaningful assessment of how many terrestrial calls are potentially affected by its operations, relying on inappropriate statistical and probability computations to minimize the effect of its transmissions. There are, indeed, only a small number of aircraft (1400) equipped with AirCell mobiles, and there is comparatively little use of the

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88 *See* AirCell Review at 2.4-23.

89 V-Comm Response at 42.

AirCell network (30,000 minutes per month, or less than 22 minutes per month per mobile).[90] Given the intensive use of the terrestrial cellular network by over a hundred million units, however, a single AirCell transmission has the potential to disrupt or harmfully interfere with many terrestrial calls. V-Comm constructed its Case Study to provide a basis for estimating how many terrestrial calls will be potentially affected by a given airborne call. It explains that the Case Study uses "the controlled test data from its flight tests and cross-interference tests to accurately depict the potential extent of interference that can be expected from airborne units. This model is a valid and sound approach to depict the true effects of harmful interference that can exist if AirCell continues to operate under its current waiver and its subscriber base continues to grow."[91]

AirCell, of course, to survive must find fault with the Case Study, which shows the devastating extent of the interference that its airborne operations will cause to terrestrial service. Amazingly, none of the arguments recited by AirCell against the Case Study actually is directed to the Case Study itself. Most, in fact, merely rehash arguments AirCell had already made regarding the Noise Floor Study, the flight tests, or the Phase 2 tests.[92]

The one new argument AirCell makes in connection with the Case Study is that it claims to have developed a "sophisticated mathematical model of an aircraft flying over terrestrial cell sites, and this model includes all of the antenna variables, correct propagation loss assumptions, and has been validated by over 4000 hours (close to one million miles!) of flight test data."[93] According to AirCell, its model produces results at odds with V-Comm's Case Study.

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90 AirCell Review at 1.0-2.

91 V-Comm Response at 43.

92 V-Comm has addressed AirCell's reiterated objections in detail at pages 44-49 of the V-Comm Response, in Appendix I.

93 AirCell Review at 2.5-1.

Nevertheless, AirCell has chosen to keep both this model and its associated data to itself. It has placed neither the model nor the data in the public record. As a result, AirCell again implores the Commission, "Trust us." The Commission cannot, however, base a determination of non-interference on data and models that are not part of the record. As V-Comm puts it, "If AirCell believes such sources to be valuable data to support its non-interference claims, it should submit them to the FCC. AirCell must do more than just convince itself that its system does not cause harmful interference. As that is exactly what it is doing by conducting tests and reviewing supportive data in secrecy. Its burden as a secondary service provider in the cellular spectrum requires that it share such types of data and provide such evidence of non-interference."[94]

Despite allegedly possessing this mountain of data and sophisticated model for analyzing it, AirCell has continued to rely almost exclusively on the very limited data from the 1997 Texas tests in support of its waiver extension. If AirCell has close to a million miles of data and a sophisticated method for analyzing it, there is no excuse for its decision to make FCC filings that rely on, in V-Comm's words, "a single day of flight testing representing approximately 850 miles of flight tests from 1997 with only 1 of the 2 types of aircraft antennas that AirCell offers today."[95]

The data underlying V-Comm's Case Study, on the other hand, is based on 10,000 miles of flight testing, and is extensively summarized in V-Comm's report accompanying the Comments in Opposition. Given that the Commission cannot consider the data and model that AirCell has failed to present, the best basis for decision is the data presented by V-Comm and the Case Study that models the interference outcome.

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94 V-Comm Response at 45 (emphasis in original).

95 *Id.*

V. THE NEW INFORMATION PROVIDED BY AIRCELL DOES NOT SUPPORT RELIANCE ON AIRCELL'S 1997 FLIGHT TESTS

AirCell's engineering exhibit contains a section discussing new data not in either the 1997 test record or the Petition for Extension. AirCell claims that this new data reaffirms its conclusion, based on the limited 1997 data, that its service does not cause harmful interference to terrestrial cellular service.[96]

A. Newly Revealed 1998 and 2003 Test Data

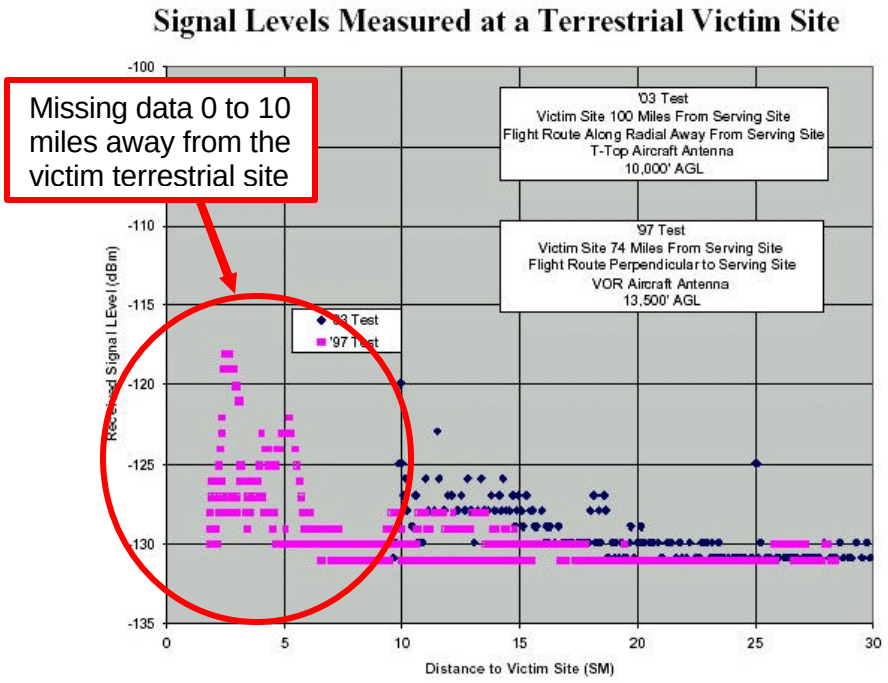
From its supposed secret database of test results, AirCell provides two limited sets of test data. According to V-Comm, the test results presented do not reaffirm the 1997 tests. The first set of test results compares a 1997 test flight with a 2003 test flight, where the two flights used different antenna configurations. According to AirCell, "the very similarity of the two data sets indicate that the aircraft antenna type does not affect the measured signal levels on the ground to any significant degree."[97]

V-Comm, however, disagrees. The test results, which are depicted in a single graph, show markedly different performance:

96 *See* AirCell Review at 2.6-2.

97 *Id.* at 2.6-3.

Figure 2. **V-Comm's Annotation of AirCell Aircraft Antenna Comparison**[98]



V-Comm's analysis is as follows:

> As can be seen in the figure above, AirCell's 2003 flight data is missing the most critical part of the flight test, where the AirCell equipped aircraft is within 10 miles of victim site and where the highest levels of interference from the AirCell signals would be received by the terrestrial site. AirCell states that the call dropped approximately ten miles from the victim terrestrial site that it selected for inclusion in such flight test. Again, this new data does very little to support AirCell's claim of non-interference to the terrestrial network, and only shows the 'better case' scenario of an aircraft maintaining a call greater than 10 miles from a victim site, and for only one flight path and altitude.
>
> In addition, as observed from the figure above, the measured AirCell received signals are approximately 2-3 dB higher than what was reported in its 1997 flight data. One could extrapolate that the signals would further increase as the airplane approached the victim site, however not enough test plan information is provided by AirCell.[99]

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[98] V-Comm Response, Figure 7-A, at 52, adapted from AirCell Review, Figure 2.6.b.0, at 2.6–2.

[99] V-Comm Response at 52.

V-Comm notes that for the 2003 flight, AirCell does not provide supporting details, such as maps, flight path, information about the base station antennas, the DPC levels employed, and the DPC settings for the serving site; moreover, the altitudes of the two flights are different (13,500 feet vs. 10,000 feet), as are the distances between the serving and victim sites (76 miles vs. 100 miles) in the 1997 and 2003 tests. As a result, this is not a controlled test, and it is impossible to determine whether the two sets of data can be compared, much less draw any useful conclusions.[100] Thus, the Commission cannot find that the 2003 test somehow bolsters the 1997 test.

The second test described by AirCell is an "independent" test performed by an AirCell partner carrier in 1998 in the same general area as the 1997 tests. In this test, a semicircular route was flown around the victim cell site and the received signal strength is compared to the received signal strength of two mobiles units. V-Comm finds that this test provides little useful information because of what is left undisclosed:

> AirCell's flight test in 1998 attempts to provide additional aircraft orientations to the record that were missing from its 1997 flight test filing. AirCell attempts to show that this single flight plan (orientation and altitude) exhibits similar measured signal levels at a terrestrial victim site. With this new data, AirCell again does not provide enough details of the flight test to evaluate such data. Missing are details of the aircraft antenna type used for this test, the base site antenna orientation & type, AirCell DPC & maximum power settings, and the actual signal levels that occurred during tests. Without this information, it is difficult to assess the validity of AirCell's claims for this flight. Also, it should be observed that this new flight is only performed at a single altitude of 15,000 feet, and does not get any closer than 25 miles from the victim terrestrial site on the arc pattern. At lower altitudes and at closer distances when the aircraft is parallel to the victim site are the areas of concern, where the aircraft is significantly more likely to

[100] *See id.* at 52-53 AirCell would be well advised to follow its own advice regarding controlled tests, where only one factor is varied and all others remain constant. *See* AirCell Review at 2.4–21.

> cause higher signal levels to be received by the victim terrestrial site. With this new flight data, AirCell is once again attempting to show a 'better case' flight path scenario, as compared to other less favorable flight paths that show higher received AirCell signals by the terrestrial network.[101]

V-Comm's conclusion regarding the two additional tests selectively presented by AirCell is that they do not present any new information regarding the situation where interference is most likely to occur, namely, when the aircraft is within about 10 miles of the victim cellsite at lower altitudes. AirCell's presentation of these two irrelevant studies suggests that either it has no data in its nearly-a-million mile database about such situations or it is "selectively excluding" such data from the record.[102]

V-Comm notes that AirCell takes the raw data from the two newly disclosed tests and subjects it to the same kind of probability manipulations it applied to its 1997 tests. Those manipulations are no more valid today than they were in 1997. "Consequently, any conclusions drawn from these analyses are not valid."[103]

B. New Operating Noise Floor Data

AirCell's Reply also introduces three new noise floor measurements that undermine, rather than support, its claim that the noise floor is much higher than V-Comm has shown. In fact, *two of AirCell's new measurements support the conclusions of the V-Comm Noise Floor Study*.

Maddill. AirCell supplies a noise-plus-interference histogram for the victim site (Maddill) in connection with the 1998 flight test discussed above in its Figure 2.6.b.3. The chart shows that the vast majority of the noise measurements (over 80%) are in bins located at -127

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101 V-Comm Response at 53 (footnotes omitted).

102 *Id.*

103 *Id.* at 54. The Commission has not relied on AirCell's probability manipulations to date.

dBm or lower.[104] The chart depicts a mean operating noise floor of -126.9 dBm.[105] Given this measured result, AirCell cannot maintain that the noise floor should be set at -115 dBm, as in AirCell's TDMA tests.[106]

Tulsa. AirCell presents a noise plus interference histogram for a Tulsa suburban cellsite in its Figure 2.6.c.2. This chart shows the mean operating noise floor to be -124.03 dBm.[107] According to AirCell, the highest noise plus interference measurement in the histogram is -113 dBm. Instead of using the mean or 90% noise floor, however, AirCell maintains that this chart justifies the use of the steady-state -114.2 dBm noise floor it injected in its TDMA tests. The measurement of a peak noise level of -113 dBm, with a mean at -124.03 dBm, does not, however, justify AirCell's conclusion that *all* calls need to be 17 dBm above that peak level to be of reliable quality, which is the result of using the injected noise mask level in its TDMA tests. V-Comm's reaction is that "higher noise floor values injected in its cross interference tests mask the levels of AirCell's signals, biasing test results favorably to AirCell's advantage. Therefore, the conclusions of AirCell's cross interference tests with TDMA technology are entirely invalid. AirCell also utilizes many other inappropriate parameters for these tests as stated within V-COMM's report."[108]

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104 *See* AirCell Review at 2.6-9, Figure 2.6.b.3 (reproduced with annotations in V-Comm Response, Figure 7-B, at 55).

105 *See id.* From the chart, it appears AirCell did not follow its own advice to discard the lowest three non-zero bins of data. Even if it had, however, the bins discarded would have been relatively insignificant ones below -131 dBm, and the mean operating noise floor would have stayed about the same.

106 *See id.*

107 *See* AirCell Review at 2.6-20, Figure 2.6.c.2 (reproduced with annotations in V-Comm Response, Figure 7-C, at 56). In this chart, unlike the Maddill chart, AirCell appears to have followed its own advice and discarded the lowest three non-zero bins of data.

108 V-Comm Response at 55-56.

Camden. AirCell presents a noise plus interference plot vs. frequency (not a histogram) for each of 24 hours for a CDMA site in Camden that was also part of the V-Comm AMPS Noise Floor Study.[109] AirCell's plot is misleading, because it does not depict the full range of measured noise plus interference levels within any given hour; nor does it depict average or median noise levels. Instead, it shows only the 90th percentile measurements — the level that is exceeded only 10% of the time by the measured data. V-Comm notes that this "presents the measurement data in a misleading light," because each line on the chart "represents only the highest 10% of the data recorded for that hour which is of course, 1/24th of a day. This means that each single line represents only 0.1 x 1/24, or 0.42 % of the entire data set for the entire day, and the actual operating noise floor level at the CDMA site is lower than this level 99.6% of the time."[110]

Moreover, the vast majority of the CDMA noise data even on this misleading plot occur at a much lower level than the -98 dBm level AirCell injected during its CDMA test. V-Comm notes that only one line on the graph reaches the -98 dBm level, and that is well outside the bounds of the CDMA channel, at a frequency used for analog service. Within the CDMA channel, most of AirCell's lines show that the 90% noise floor is in the -100 to -105 dBm range, well below the "noise floor" that it injected. As a result, V-Comm concludes, "The average and median noise floor levels can be expected to be much lower than the –100 dBm level. Clearly, using this chart to justify a –98 dBm noise level that AirCell used in their CDMA cross interference tests is misleading."[111]

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109 AirCell Review at 2.6-23, Figure 2.6.c.4 (reproduced with annotations in V-Comm Response at 57, Figure 7-D).

110 V-Comm Response at 56.

111 V-Comm Response at 57.

VI. THE VIRTUAL IMPOSSIBILITY OF DETECTING AND IDENTIFYING AIRBORNE INTERFERENCE

Commenters have long taken the position — ignored by the Commission — that interference to terrestrial cellular service caused by airborne transmitters is virtually impossible to detect, even if severe. As a result, the complaint-based process for enforcing AirCell's secondary status is unworkable, and AirCell's claims to have operated for years without interference complaints should be given no weight. Most recently, this position was explained in detail in the Comments in Opposition and the accompanying V-Comm Report.[112] AirCell has now provided support for Commenters' concern about the infeasibility of the complaint-based process.

In particular, AirCell's filing includes a 1998 report by Dr. John R. Doner concerning the effect of illegal airborne use of unmodified mobile phones.[113] AirCell does not indicate why this report is only now being submitted, even though it was prepared when its original waiver application was pending before the Commission. Now that it is part of the record, however, the Commission cannot ignore the infeasibility of an enforcement system that is premised on terrestrial carriers being able to make complaints if and when interference occurs.

Dr. Doner writes that "illegal airborne calls . . . are no doubt almost never detectable in the system, [but] may be responsible for a substantial portion of many AMPS providers' maintenance budget, not to mention customer complaints and churn."[114] He adds that "cellular providers can be very substantially affected by illegal airborne calls, and really have no means

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112 *See* Comments in Opposition at 16-17; V-Comm Report at § 9.2.

113 John R. Doner, Ph.D., *An Analysis of the Interference Effects of Illegal Airborne Cellular Telephone Calls,* contained in Appendix B to AirCell Review.

114 Doner at 6, 29.

whatsoever to even detect this activity and thereby press action against such transgressors."[115] V-Comm points out that what Dr. Doner wrote about interference from *illegal* airborne cellphones is equally true of any interference that may be caused by AirCell's *legal* airborne cellphone usage. V-Comm notes that Dr. Doner's paper does not compare the interference effects of AirCell transmissions and illegal airborne use of standard cellphones. Based on a comparison of AirCell versus analog and digital handheld phones' maximum output power, antenna gain, and other factors, V-Comm concludes that the AirCell system "offers little protection compared to regular cellular phones used illegally on-board airplanes in-flight"[116]

V-Comm concludes that Dr. Doner appears to "agree[] with V-COMM's assessment that the terrestrial cellular providers are not able to detect this type of interference from airborne transmissions. The Commission should take these statements under consideration, concerning AirCell's claim that terrestrial networks have 'no reported incidents of interference.'"[117]

VII. OTHER ISSUES

V-Comm's Response addresses numerous other issues raised principally in the AirCell engineering exhibit. Accordingly, the Commission should fully consider the detailed technical response prepared by V-Comm in reaching its decision. For example, V-Comm responds to AirCell's claims that the comments filed by Lucent call into question aspects of V-Comm's test results. V-Comm shows that AirCell has taken statements by Lucent out of context and

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115 *Id* at 6, 34.

116 V-Comm Response at 66.

117 V-Comm Response at 65. V-Comm also notes that Dr. Doner identifies the deactivation of *idle* channels due to undesired signals received from an airborne transmitter (and their resulting removal from the available pool of channels at a site) as a form of interference in addition to directly causing the dropping of a cochannel call, *see* Doner at 6, and this had been previously cited as an untraceable form of interference that could be caused by AirCell operations. *See id.*

mischaracterized its comments.[118] In addition, Lucent has responded directly to AirCell's criticisms.[119]

CONCLUSION

For the foregoing reasons, and as stated in the Comments in Opposition, the Petition filed by AirCell and its Partners for extension of their waiver of the airborne cellular rule must be denied in its entirety.

Respectfully submitted,

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118 *See* V-Comm Response at 5, 60-64.

119 *See* Ex Parte Further Comments of Lucent Technologies, Inc., Docket 02-86 (filed Oct. 9, 2003).

EXHIBIT I

CERTIFICATE OF SERVICE

I, Michael Deuel Sullivan, hereby certify that copies of the foregoing "Rebuttal to Reply Comments of AirCell, Inc." were served this 15th day of October, 2003 via first class U.S. mail (or by hand delivery if designated with an asterisk) on the parties below.

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